

FCC – Public Safety 700 MHz Standards

January, 2010



Agenda

1. 3GPP Release 8 LTE is the correct long term choice
2. Public Safety customer demand for early deployments
3. 3GPP Standards
4. Availability of LTE equipment
5. Equipment support for 700 MHz Band 14
6. Availability of 3GPP pre-Release 8 equipment
7. Seamless evolution to Release 8 and beyond
8. Benefits of multi-agency networks

3GPP Release 8 LTE is the correct long term choice

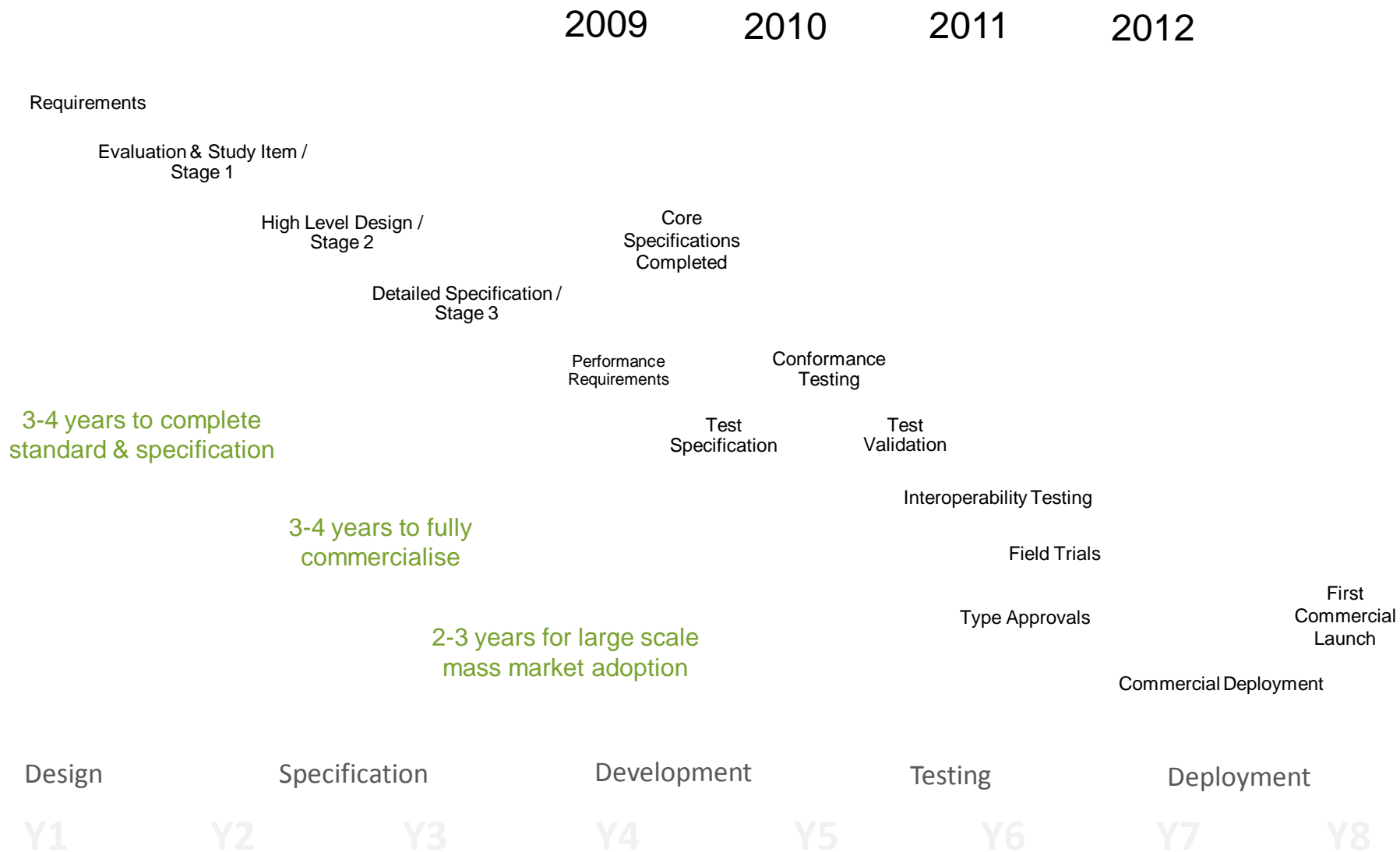
- 3GPP Operator support
 - Over 3.5 billion 3GPP subscribers
 - 211 operators in 90 countries offering HSDPA
 - 120 operators announced commitments to LTE
- Ecosystem
 - Largest ecosystem of all wireless standards
 - Maximum innovation, economies of scale
- Fit to 700 MHz spectrum
 - FDD operation in paired spectrum
 - Optimized for 5 and 10 MHz channelization
 - Inherent single frequency network operation (n=1 reuse)
- Architecture suits public safety requirements
 - IP Packet based, shared channel architecture – allows large numbers of active users in incident situations
 - Quality of service mechanisms provide priority by user as well as application
 - Backward compatibility with UMTS and GSM/EDGE allows for universal roaming

LTE Challenges

- Time to commercialization
 - Standardized in 2009 – typically new standards take 4-6 years to commercialization
- Spectrum
 - Large number of bands to be supported in User Equipment
- Cell edge performance
 - Improving cell edge throughput with $n=1$ reuse subject to ongoing work
 - Important for when public safety incident occurs at the cell edge
- Optimized for small cells in urban environments
 - Not inherent in technology, but commercial operators will initially deploy in these environments, as existing technologies serve rural areas adequately
- Voice Services
 - Not yet fully standardized
- Implementation Priorities
 - Major vendors naturally focussing on the bands and requirements of major commercial operators

⇒ *IPW initial focus on meeting requirements of government markets*

Implementation of a new 3GPP Standard



LTE as Part of 3GPP Standards Evolution

- LTE is not a standard in its own right
 - *Rather, it's a release in the 3GPP evolution (Rel 8)*
 - *Will continue to evolve in later releases (Rel 9, 10 etc)*
 - *3GPP technologies intended to work together to serve market needs*
- LTE trial deployments in 2010 and into 2011 is likely not to be fully standards compliant (prior to interoperability testing)
- 3GPP standards require backward compatibility
 - User Equipment will be multimode, supporting earlier releases
- Other 3GPP technologies will continue to evolve

Important for Public Safety to adopt the 3GPP family of standards rather than a particular release

The Large Number of LTE Bands Means Vendors Have to Choose Main Global Bands for Initial Support

FDD bands

Band	Frequencies UL/DL (MHz)
1	1920 – 1980/2110 – 2170
2	1850 – 1910/1930 – 1990
3	1710 – 1785/1805 – 1880
4	1710 – 1755/2110 – 2155
5	824 – 849/869 – 894
6	830 – 840/875 – 885
7	2500 – 2570/2620 – 2690
8	880 – 915/925 – 960
9	1750 – 1785/1845 – 1880
10	1710 – 1770/2110 – 2170
11	1428 – 1453/1476 – 1501
12	698 – 716 /728 – 746
13	777 – 787 /746 – 756
14	788 – 798 /758 – 768
17	704 – 716/734 – 746

TDD bands

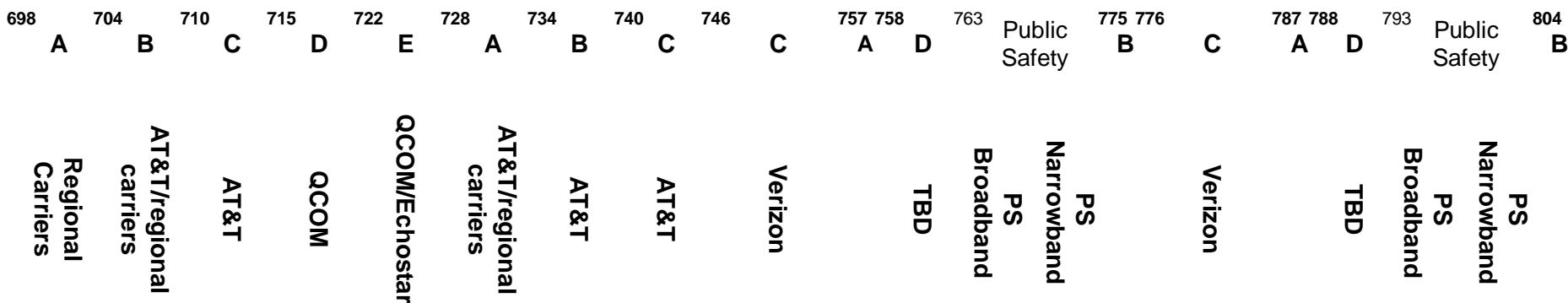
Band	Frequencies UL/DL (MHz)
33,34	1900 – 1920 2010 – 2025
35,36	1850 – 1910 1930 – 1990
37	1910 – 1930
38	2570 – 2620
39	1880 – 1920
40	2300 – 2400

In addition, User Equipment needs to support up to 7 UMTS and GSM bands

→ UE and chipset vendors have to chose a subset of bands to support

Table 1: FDD (left) and TDD (right) frequency bands defined in the 3GPP (May 2009)

700 MHz Band Support



LTE Defined Bands

Mainstream Vendors Supporting Bands 13 and 17

LTE Band 17

LTE Band 17

LTE B 13

LTE B 13

LTE Band 12

LTE Band 12

LTE B 14

LTE B 14

Almost \$1B in Stimulus Fund applications were submitted for projects that will likely be deployed in "non-mainstream" 700MHz bands

IPW UE band coverage

- IPWireless 3GPP Release 7 UE covers the **entire band**
 - Allows early public safety deployments in 2010*

Public Safety Cannot Wait for 3GPP Release 8 to be Fully Commercial

- As noted, Release 8 (LTE) not likely to be fully commercial until 2012
- Many cities and agencies have immediate needs, as evidenced by 700 MHz waiver requests
- 3GPP Release 7 technologies can serve these needs
- With Software Defined Radio (SDR) technology in base stations and UEs, a smooth upgrade to Release 8 can be supported

Software Defined Radio Technology Allows Evolution Between 3GPP Releases, including Parallel Operation

Release 7 TD-CDMA



SDR (FPGA based) NodeB

Release 8 LTE



Software and baseband code
Change from Rel 7 to Rel 8

Dual Mode Rel 7 / Rel 8



*Operates in either Rel 7
or Rel 8 mode*

OTA Rel 8 Software Upgrade,
Transparent to user

Both Rel 7 and Rel 8 code
held in UE memory

SDR based UE
Operates as Rel 7

Forward Thinking Municipalities are Thinking Beyond Public Safety

The Multi-Agency Government Wireless Network

Public Safety Applications

Government Services

Priority Access

Broadband Incident
Communications

Emergency Call
Boxes

Campus security

Full IT
applications
access in the field

Video

Utility Meter
Reading

City Worker
Communications

Geospatial Incident
Mapping

Mobile
Control
Centres

Transit Broadband

Intelligent Traffic
Systems

Automatic Vehicle
Location

Dispatch
&
Control

Automated Vehicle
Location

Traffic Light
Automation

- *Combining Public Safety and Government applications is crucial to economies of scale and widening funding sources*

Recommendations

- *Adopt 3GPP standards family for Public Safety, rather than a specific 3GPP release*
- *Allow 3GPP Release 7 for deployments under waivers, conditioned on fully interoperable Release 8 LTE by a defined date*
- *Expand the definition of Public Safety to enable shared public safety / Government networks*